TY-KH65-004A

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KH65
Diaphragm-seal Pressure Transmitter for High Temperature

USER'S MANUAL

NAGANO KEIKI

2014.10

7.1

MANUAL FOR ACCURATE AND SAFE OPERATION

SAFTY CHAPTER
FOR
DIAPHRAGM-SEAL PRESSURE TRANSMITTER
FOR HIGH-TEMPERATURE

To use these devices accurately and safely, carefully read this manual and the operation manual. Incorrect usage may cause malfunction and result in human injury, accidents, etc. Be sure to keep this manual for reference after reading.

WARNING

1. Do not apply more than the maximum allowable pressure.
   Human injury or damage to surroundings may result due to explosion or breakdown of the pressure elements.

2. Do not use these devices on measured objects which are corrosive to fluid or gas contacting areas.
   Human injury or damage to surroundings may result due to explosion or breakdown of the pressure elements and exposure of dangerous measured objects.

3. Do not apply excessive weight, vibration or shock.
   Human injury or damage to surroundings may result due to explosion or breakdown of the pressure elements and exposure of dangerous measured objects.

4. Use with the unspecified power supply may cause fire hazard or electric shock.

5. Use with the instrument temperature range.
   Use outside the instrument temperature range may cause human injury or damage to surroundings due to explosion of breakdown of the devices.

6. Connect wiring accurately according to the wiring drawings or instructions in the operation manual.
   Incorrect wiring may result in human injury or fire hazard.

7. Use devices with an explosion-proof construction when operating in place liable to have explosive gas.
   Danger of ignition and explosion.

8. Never use the transmitter for the production of food, chemicals or their containers to prevent accidents, if mercury is used as sealing liquid.
   Never use this transmitter if there is a danger of direct influence on the quality of products due to sealing liquid leakage.

9. Do not overheat with a burner, etc. when removing resin on the head of the transmitter. Overheated sealing liquid may cause malfunction due to deformation of the diaphragm, or may make the transmitter inoperable and contaminate the surroundings due to sealing liquid leakage.

10. Accurately install these devices according to the installation instructions in the operation manual.

11. Never attempt to reconstruct the main body of devices nor add any new function to the devices, etc. Contact us for repairs.

Note: Inform us in advance when using these devices in a way that may result in fatal or serious injury due to malfunction or incorrect operation.

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1. Preface

Conventionally, diaphragm (fill fluid: mercury) pressure gauges are used to measure the pressure of molten substances at high temperatures, as well as highly viscous liquids at room temperature.

Among pressure gauges, there are five different diaphragm sizes: ϕ8, ϕ10, ϕ18, ϕ23.6, and ϕ37. However, when the diaphragm diameter is relatively large, there is danger of pockets forming in the pipe line. These pockets can, for example, cause partial retention of dissolved resin in plastic extruders, resulting in defects in the resin. The solution to reducing these pockets is to use pressure gauges with small diameter diaphragms.

Nagano Keiki Co., Ltd. uses ϕ8, ϕ10, and ϕ18 diaphragms to manufacture the model KH65 Diaphragm-seal Pressure Transmitter. (It can also be made with (ϕ23.6 or ϕ37 diaphragms)

Please read this instruction manual thoroughly to ensure correct and effective use.

2. Application

This device is suitable for measuring the pressure of molten substances at high temperatures, as well as highly viscous substances at room temperature. It can be used in such fields as synthetic chemistry, textile chemistry, and in the plastics industry.

3. Features

(1) The sensing part uses a pressure-sensitive unit with a built-in semiconductor strain gauge, which grants superior durability and stability.

(2) The front side lid can be easily removed, allowing for easier zero span adjustment.

(3) The small diameter of the pressure detector section prevents retention, making it more effective.

(4) The flat surface of the diaphragm prevents the body to be measured from accumulating on it.
(Some accumulation may occur if there is a protector)

(5) The section between the pressure receiving part and the strain gauge unit is welded together, without the use of gaskets or screws, which reduces leakage.

(6) The pressure receiving part has a special structure that reduces the amount of mercury filling the system between the pressure receiving part and the strain gauge unit as much as possible. Together with narrow capillaries, this reduces the range of error caused by temperature changes.

(7) The special structure of the pressure receiving part allows use ϕ8 diaphragms up to 400℃. (optional)

(8) Either mercury (standard) or X3 (NKS instrument oil: silicon fill fluid) can be used as the fill fluid, as necessary for different features.

4. Specifications

(1) Production pressure range and accuracy

Filled liquid									
Mercury					X3				
Diaphragm diameter	Connection	Pressure range (MPa)	Output (%F.S.)	Maximum lead length	Diaphragm diameter	Connection	Pressure range (MPa)	Output (%F.S.)	Maximum lead length
8 DIA.	G1/4B or 1/2-20UNF	0 to 10	± 2.0	2 m					
		0 to 15							
		0 to 20	± 1.5						
		0 to 25							
		0 to 30							
		0 to 35							
		0 to 50							
		0 to 70							
10 DIA.	G3/8B or G1/2B	0 to 10	± 2.0						
		0 to 15							
		0 to 20	± 1.5						
		0 to 25							
		0 to 30							
		0 to 35							
		0 to 50							
		0 to 70							
18 DIA.	G3/4B	0 to 5	± 0.75	10 m	18 DIA.	G3/4B	0 to 25 0 to 30 0 to 35 0 to 50	± 1.5	3 m
		0 to 10							
		0 to 15							
		0 to 20							
		0 to 25							
		0 to 30							
		0 to 35							
		0 to 50							
		0 to 70							
23.6 DIA.	G1B	0 to 5	± 0.75		23.6 DIA.	G1B	0 to 10 0 to 15 0 to 20 0 to 25 0 to 30 0 to 35	± 1.5	
		0 to 10							
		0 to 15							
		0 to 20							
		0 to 25							
		0 to 30							
		0 to 35							
37 DIA.	Flanged type or G1・1/2B	0 to 0.6	± 1.5	5 m					
		0 to 1.0							
		0 to 1.5	± 1.5	10 m					
		0 to 2.5							
		0 to 3.5							
		0 to 5.0							

(2) Power Source : 24VDC ±10% (2 wire system)

(3) Output : 4 to 20mADC (load resistance 500 Ω max.)

(4) Allowable maximum pressure : 120%F.S.

(5) Operating temp. range : Detector section 0 to +300°C

Circuit section 0 to +50°C

(6) Allowable temp. range : Detector section 0 to +330°C (standard) 0 to +400°C
(for 400°C specs at 8dia.)
Circuit section 0 to +60°C

(7) Detector section temp. coefficient : ±5kPa/°C (zero point)

(8) Ambient temp. coefficient : ±0.05%F.S./°C

(9) Wetted parts materials : SUS316 (standard) , SUS316L or Hastelloy C

(10) Connection material : SUS420J2

(11) Case material : ADC12

(12) Case exterior : Gray crystal paint

(13) Terminal port size : JIS F8801 20b

(14) Insulation resistance : ≧100MΩ (at 50V DC)

5. Outline dimensions

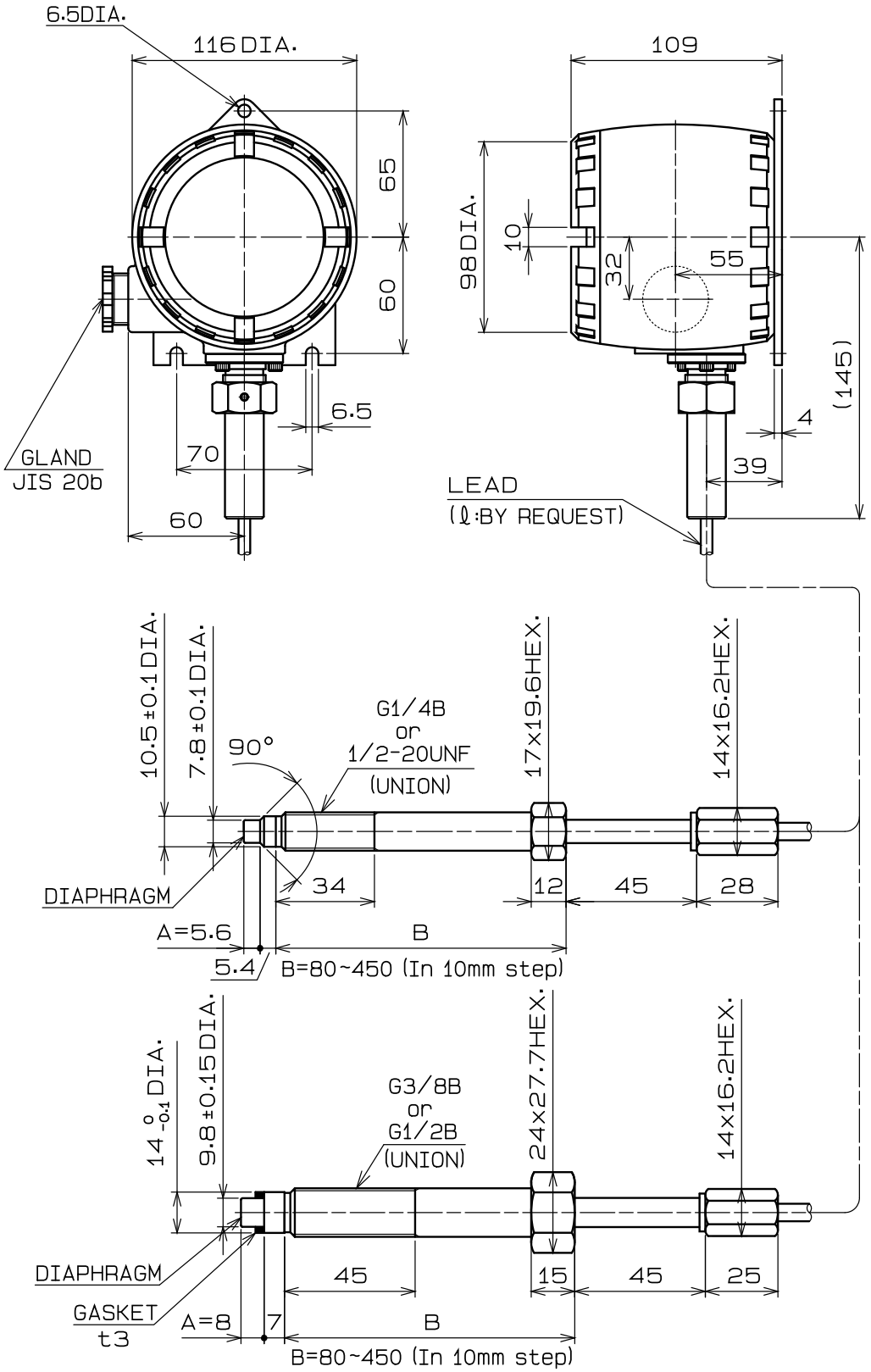
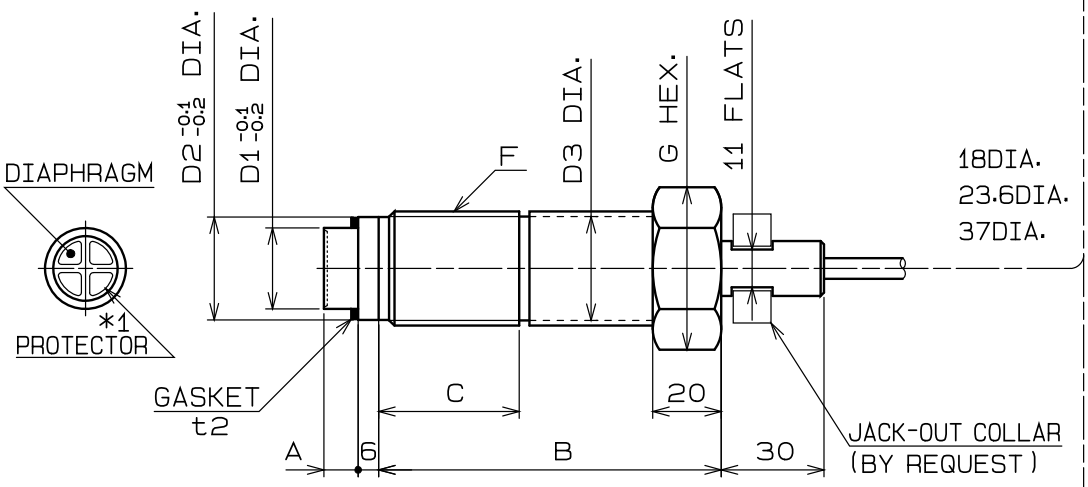


Fig.1a

Fig.1b



18DIA. Dimensions		
A	10.15.20.25.30	
B	55	80~450 (In 10 step)
C	25	45
D1	18	
D2	24	
D3	23.5 (If thread relief)	
F	G3/4B	
G	36x41.6	

23.6DIA. Dimensions		
A	10.15.20.25.30	
B	55	80~450 (In 10 step)
C	25	45
D1	23.6	
D2	30	
D3	29.5 (If thread relief)	
F	G1B	
G	41X47.3	

37DIA. Dimensions		
A	10.15.20.25.30	
B	55	80~450 (In 10 step)
C	25	45
D1	37	
D2	44	
D3	44 (If thread relief)	
F	G1 · ½B	
G	50X57.7	

*1:Selectting the protector.

37DIA. Dimensions

JIS 10K 10A ~ JIS 40K 50A
ANSI 1B 150psi ~ ANSI 2B 600psi
Each dimensions are differ by flange.

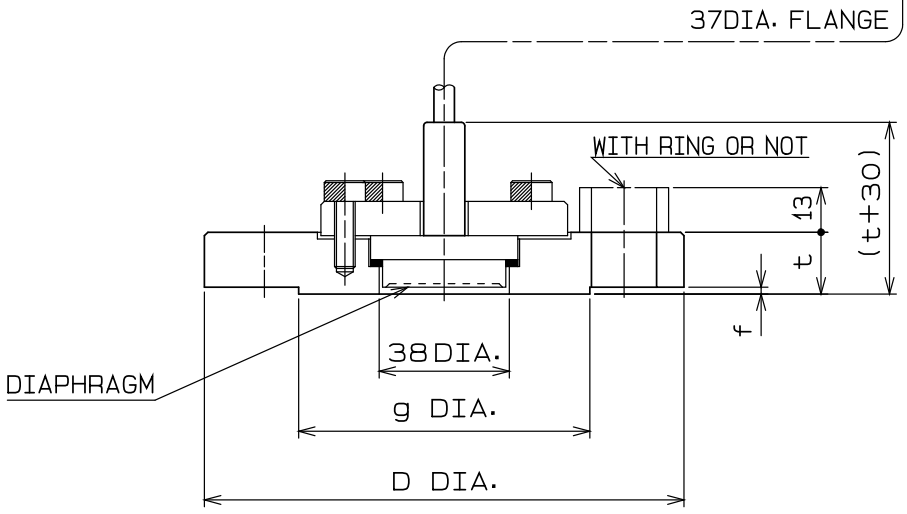


Fig.1c

6. Notes on transportation, storage, and unpacking

6-1 Notes on transportation

This device is a precision instrument.
Dropping or causing sudden impact to the device may render it unusable. Take due precautions when transporting the device.

6-2 Notes on storage

Store this device in a dry place, free of vibrations and dust.
When stacking it among other items, take care not to distort the shape of the box or place it where it may fall.

6-3 Notes on unpacking

Handle the packing box with care when unpacking this device.
Open the package in an area wide enough that you do not accidentally drop the device.

7. Operating Principles

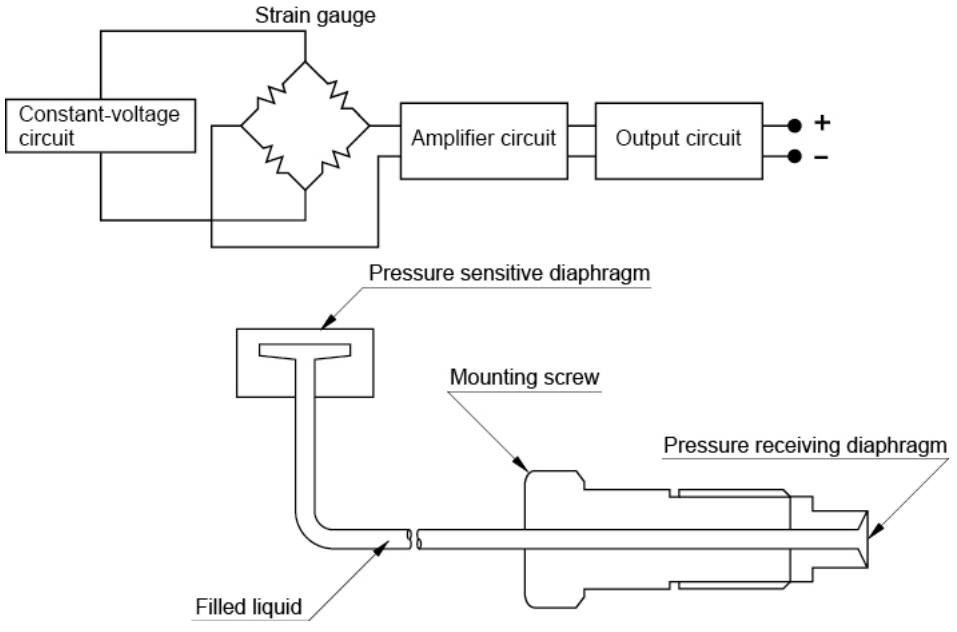


Fig.2

The Diaphragm-seal Pressure Transmitter for High Temperature consists of a converting part and pressure receiving part (diaphragm pressure receiving part) connected by a conduit, filled with a pressure transmission fluid inside.

The fluid to be measured acts on the Pressure receiving diaphragm surface. Pressure detected is transmitted to the pressure sensitive diaphragm through the fill fluid. DC current proportional to the pressure is then produced by the strain gauge and electrical circuit.

8. Mounting and dismounting

8-1 Regarding head difference

Because of the high specific gravity of mercury, if there is a big head difference between the heads of the sensing part and the pressure receiving part, a large load will be placed on the diaphragm or the pressure element. This can result in damage to the device. The allowable head difference range is illustrated in the graph below. If there is a head difference, be sure to notify Nagano Keiki immediately. Adjustments will be made at the factory.

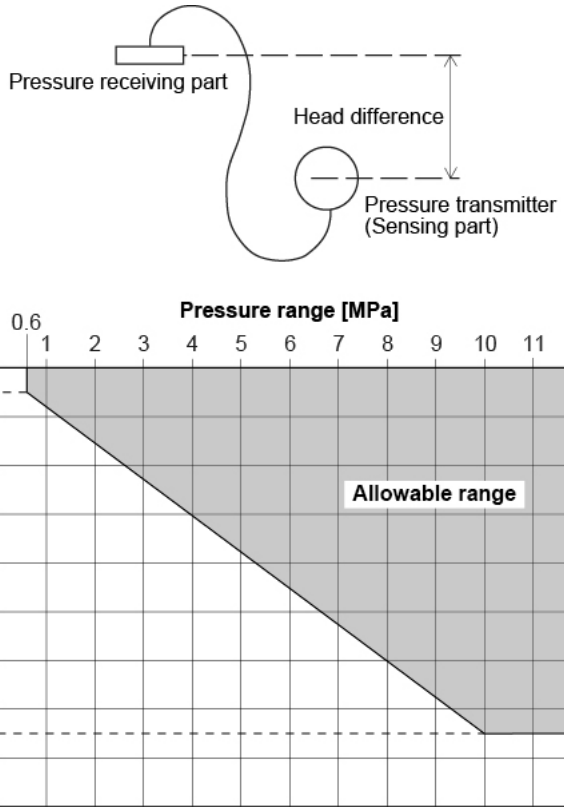


Fig.3

Note: Mounting the sensing part higher than the pressure receiving part is unadvisable.

8-2 Converting part

- Standard mounting orientation is vertical.
- Mount directly on the panel.
  2B pipe can also be mounted on the mounting bracket. (optional)
- Do not apply sudden force when mounting. This may damage the interior of the device.
- Do not mount this device where it may be exposed to high temperatures, vibrations, rain, or moisture.

8-3 Conduit part (lead unit)

The Diaphragm-seal Pressure Transmitter will cease to function if the fill fluid leaks. Please take special care when handling the capillary tubes, which are vulnerable to twisting.

The capillary tube is made to function in a coiled position. Return it to a natural position when mounting. Minimum bending radius is 30 mm.

Do not squeeze the capillary tube while the device is in operation. This will cut off the fill fluid between the sensing part and the pressure receiving part, and the device will cease to function.

Fix the capillary tube in a strategic position.

When carrying the Diaphragm-seal Pressure Transmitter, do not hold it by a single part such as the case, the capillary tube, or the pressure receiving part. Be certain to hold the whole device.

During wiring, piping, or construction, do not pass a current through the capillary tube, thereby causing a short circuit. Short circuits may break the capillary tube.

8-4 Pressure receiving part (diaphragm pressure receiving part)

This transmitter’s pressure receiving part is of extremely precise construction. It runs at high temperatures and high pressure during use. Take care to mount it where the diaphragm surface will not be damaged, and fasten it tightly so the diaphragm unit will not turn.

8-5 Notes on dismounting

When dismounting the detector section, take care not to damage or destroy the pressure receiving part.

If the fluid to be measured begins to solidify due to dropping temperature, dismount the pressure receiving part while the fluid around it is still hot enough to be in a liquid state.

If the temperature drops too low, the fluid to be measured may harden on the surface of the diaphragm, which can potentially destroy the detector section when it is dismounted. If the fluid to be measured does harden on the surface of the diaphragm, either apply an appropriate solvent, or heat (330°C max.) until it melts away. Do not expose the tip of the pressure receiving part directly to a burner.

When re-mounting, first perform a cleaning inspection on the mounting point, confirm that there is no hardened fluid, and take care not to damage the surface of the diaphragm.

If the diaphragm breaks and the fill fluid (mercury) leaks out, take necessary measures. To prevent pollution, seal this device in a plastic bag and consult Nagano Keiki’s service company

8-6 Recommended mounting hole dimensions

(1) Taper Seat

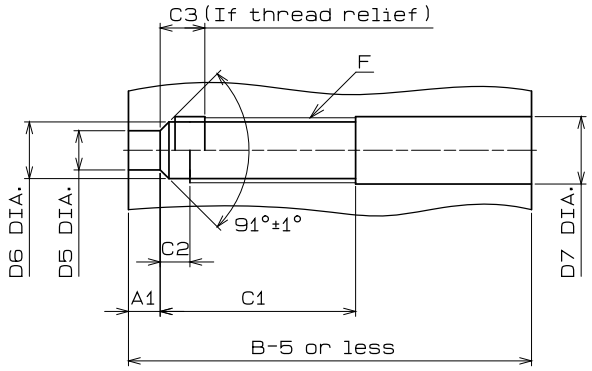


Fig.4

Diaphragm diameter	F	D5	D6	D7	A1	C1	C2	C3
8	G1/4B	7.93 $^{+0.05}_{0}$	11.5 $^{+0.3}_{0}$	13.6 or more	6.4 or more	35 $^{+3}_{0}$	6 or less	9 or less
8	1/2-20UNF	7.93 $^{+0.05}_{0}$	11.3 $^{+0.3}_{0}$	13.1 or more	6.4 or more	35 $^{+3}_{0}$	6 or less	9 or less
10	G3/8B	10.0 $^{+0.05}_{0}$	15.0 $^{+0.3}_{0}$	17.2 or more	5.8 or more	45 $^{+3}_{0}$	11 or less	14 or less
10	G1/2B	10.0 $^{+0.05}_{0}$	18.7 $^{+0.3}_{0}$	21.5 or more	5.8 or more	45 $^{+3}_{0}$	11 or less	14 or less

(2) Gasket Seat

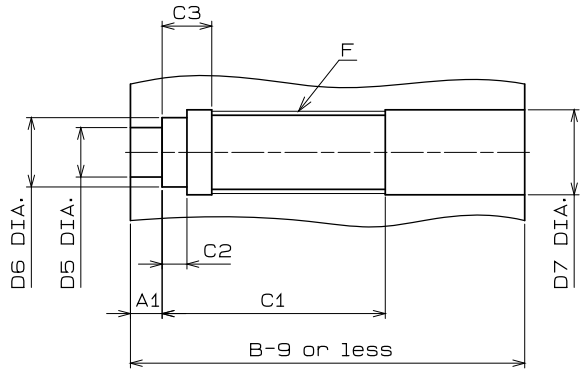


Fig.5

Diaphragm diameter	F	D5	D6	D7	A1*	C1	C2*	C3
10	G3/8B	10.0 $^{+0.1}_{0}$	14.1 $^{+0.3}_{0}$	17.2 or more	5.8 or more	45 $^{+6}_{0}$	5 or more	14 or less
10	G1/2B	10.0 $^{+0.1}_{0}$	14.1 $^{+0.3}_{0}$	21.5 or more	5.8 or more	45 $^{+6}_{0}$	5 or more	14 or less
18	G3/4B	18.0 $^{+0.1}_{0}$	24.1 $^{+0.3}_{0}$	27.0 or more	A-1 or more	C $^{+6}_{0}$	4 or more	11 or less
23.6	G1B	23.6 $^{+0.1}_{0}$	30.1 $^{+0.3}_{0}$	33.8 or more	A-1 or more	C $^{+6}_{0}$	4 or more	11 or less
37	G1 $\frac{1}{2}$ B	37.0 $^{+0.1}_{0}$	44.1 $^{+0.3}_{0}$	48.4 or more	A-1 or more	C $^{+6}_{0}$	4 or more	11 or less

* These numbers vary depending on the dimensions of the gasket in use.
This chart shows numbers using the recommended gasket.

(3) Recommended gasket dimensions

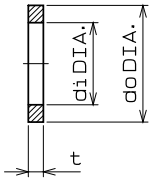


Fig.6

Diaphragm diameter	di	dO	t
10	10.2±0.2	13.8±0.1	3.0±0.1
18	18.5±0.2	23.5±0.2	2.0±0.1
23.6	24.0±0.2	29.5±0.2	2.0±0.1
37	38.0±0.2	43.0±0.2	2.0±0.1

8-7 Wiring

Make electrical connections according to the nameplate on the inside of the device's lid.

Use a stable, dedicated power supply for this device.

To avoid the risk of induction failure, do not place the output signal transmission line side by side with large load power lines that exceed 20A. In case they must be placed side by side, install a separate conduit pipe to ground them.

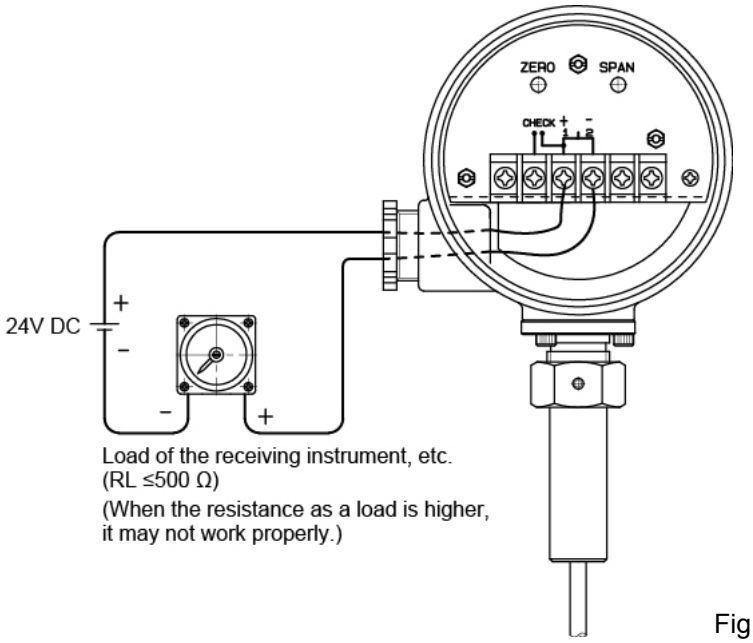


Fig.7

9. Operation

Before beginning operation, double check for mistakes in the wiring, turn on the power, and let the device warm up for 5 minutes.

Take care not to damage the pressure receiving part by applying excessive pressure.

10. Maintenance and inspection

(1) Maintenance

Once every 6 months, stop operation, check for abnormalities all parts of the device, and calibrate using a reference device as necessary. Do not make modifications or changes that result in changes to the electrical constants of the circuits, or changes to the placement of equipment conductors, connections of equipment within the conductor.

Please refer to this checklist for periodic inspection.

- Leakage of the pressure medium
- Leakage of the fill fluid
- Deformation of the equipment
- Measurement of the power supply voltage
- Measurement of the output signal (see (2) below)
- Measurement of insulation resistance

If there are defects in the pressure receiving diaphragm of the tip of the pressure receiving part, please notify us promptly to receive the necessary repairs.

(2) Inspection

Check terminals are attached to permit current value checks during operation, even without opening the circuits. Current checks can be performed by preparing an ammeter (internal resistance 20Ω or less), to be connected as shown in Figure-8.

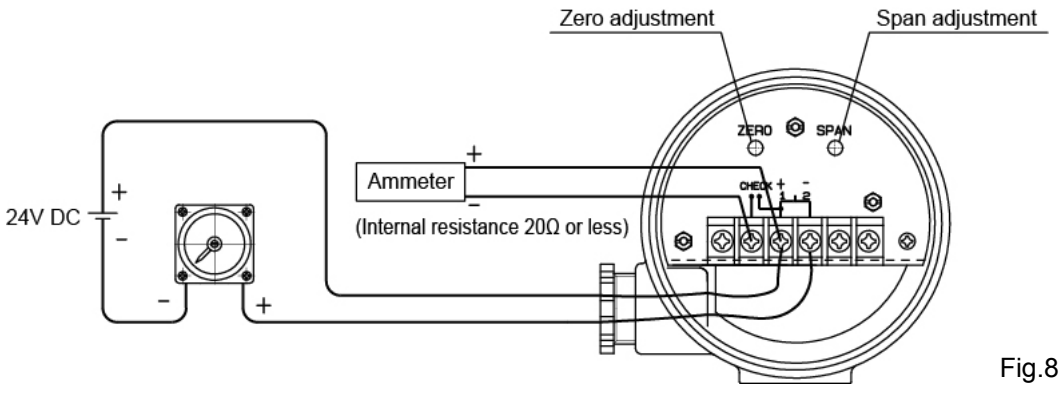


Fig.8

(3) Adjustment

1) If the zero point output at zero pressure has shifted, perform the zero adjustment appropriately.

   If there is a head difference due to the specific gravity of the fill fluid, it is possible for the zero point output to shift even at zero pressure. Perform zero adjustments at the mounting point.

2) Apply the full span pressure using the reference pressure gauge, and adjust the span if the span value has shifted.

3) In order to adjust the output correctly, repeat the zero adjustment and span adjustment in I) and II) several times as necessary.

4) A standard pressure gauge is required to perform span adjustment. If you have no standard pressure gauge, please notify our service company.

If more detailed information on maintenance and inspections is required, please inquire at our service company.

11. Warranty

If the delivered product is determined to be non-compliant due to "defects in manufacture or design" within the warranty period (1 year from delivery to the customer), Nagano Keiki will repair the product or exchange it for a compliant product at no cost. However, please note situations below, which exempt the product from this warranty.

(1) If the delivered product is dismantled, modified, has any parts replaced, or features added by the customer or a third party besides us.

(2) If the instructions detailed in this manual or the catalog are not followed.

(3) Deterioration from use, natural disasters, fire, or other force majeure.

(4) Secondary damage caused by product incompatibility, including those items listed above.

Obvious traces of misuse, including deformation of parts, wear, or burnout, shall exempt the device from its warranty, regardless of customer’s awareness of improper handling.

12. Miscellaneous

This manual is not intended to cover all details of the equipment. Nor is it intended to cover all details relating to installation and maintenance. If you require a more detailed explanation, or the device does not adequately serve your company’s intentions, please inquire with us.

Some of the information in this instruction booklet may change without notice due to revisions, etc.

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